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APPLICANTS:	Jackson et al.
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EXAMINER:	Cohen, Amy R.
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FOR:	"Invisible Target Illuminators for 3D Camera-Based Alignment Systems"

Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

May 6, 2005
St. Louis, Missouri

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THIRD-PARTY SUBMISSION
IN PUBLISHED APPLICATION
UNDER 37 CFR 1.99(a)

(Duplicate Copy Served To Applicant's Correspondence Address)

Sir:

The following information is submitted as relevant to the examination of the above-identified U.S. Patent Application published as U.S. Patent Application Publication No. US 2005/0060899 A1 on March 24, 2005. This submission is submitted within two months of the publication date of the application per 37 CFR 1.99(e), and is accompanied by the fee set forth in 37 CFR 1.17(p), as required by 37 CFR 1.99(b)(1). A duplicate copy of this submission has been served to the applicants' Correspondence Address listed on the face of the U.S. Patent Application Publication, as required by 37 CFR 1.99(c).

RELEVANT INFORMATION:

1. Hunter Engineering Company Product Literature, Form No. 4240T, dated July, 2000, "DSP400 Alignment Sensors" (8 pages total).
2. Hunter Engineering Company Product Literature, Form No. 4307T, dated April, 1999, "WinAlign Quick Reference" select pages only, including the cover page, index, and pages 17-22 describing a four wheel alignment procedure and the use of a remote indicator (page 21). (9 pages total).
3. Hunter Engineering Company Product Literature, Form No. 4240T, dated January, 1999, "DSP400 Alignment Sensors" (6 pages total).
4. Hunter Engineering Company Product Literature, Form No. 4347T, dated November, 1998, "Operation Instructions - DSP400 Series Sensors" (38 pages total).

Respectfully submitted,



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and that in compliance with 37 CFR 1.99(c) and 37 CFR 1.248(a)(4), a second copy of this correspondence and all attachments is being deposited with the U.S. Postal Service on **May 6, 2005** as first class mail in an envelope addressed to:

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Mark E. Books, Reg. No. 40,918



Date of Signature



Docket No.: HE B041

Date: May 6, 2005

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Serial No.: 10/667,522

Filed: September 23, 2003

Pub. No.: US 2005/0060899 A1

Pub. Date: March 24, 2005

For: "INVISIBLE TARGET ILLUMINATORS FOR 3D CAMERA-BASED ALIGNMENT SYSTEMS"

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Transmitted herewith is:

- ☒ Third-Party Submission In Published Application Under 37 CFR 1.99(a)
- ☒ A check in the amount of \$180.00.

The Commissioner is hereby authorized to charge any additional fees or credit overpayment under 37 CFR 1.16 and 1.17, which may be required by this paper to Deposit Account 162201. *Duplicate copies of this sheet are enclosed.*

Mark E. Books

Registration No: 40,918

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Mark E. Books, Reg. No. 40,918

5/6/05

Date



Docket No.: HE B041

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Mark E. Books
Registration No: 40,918

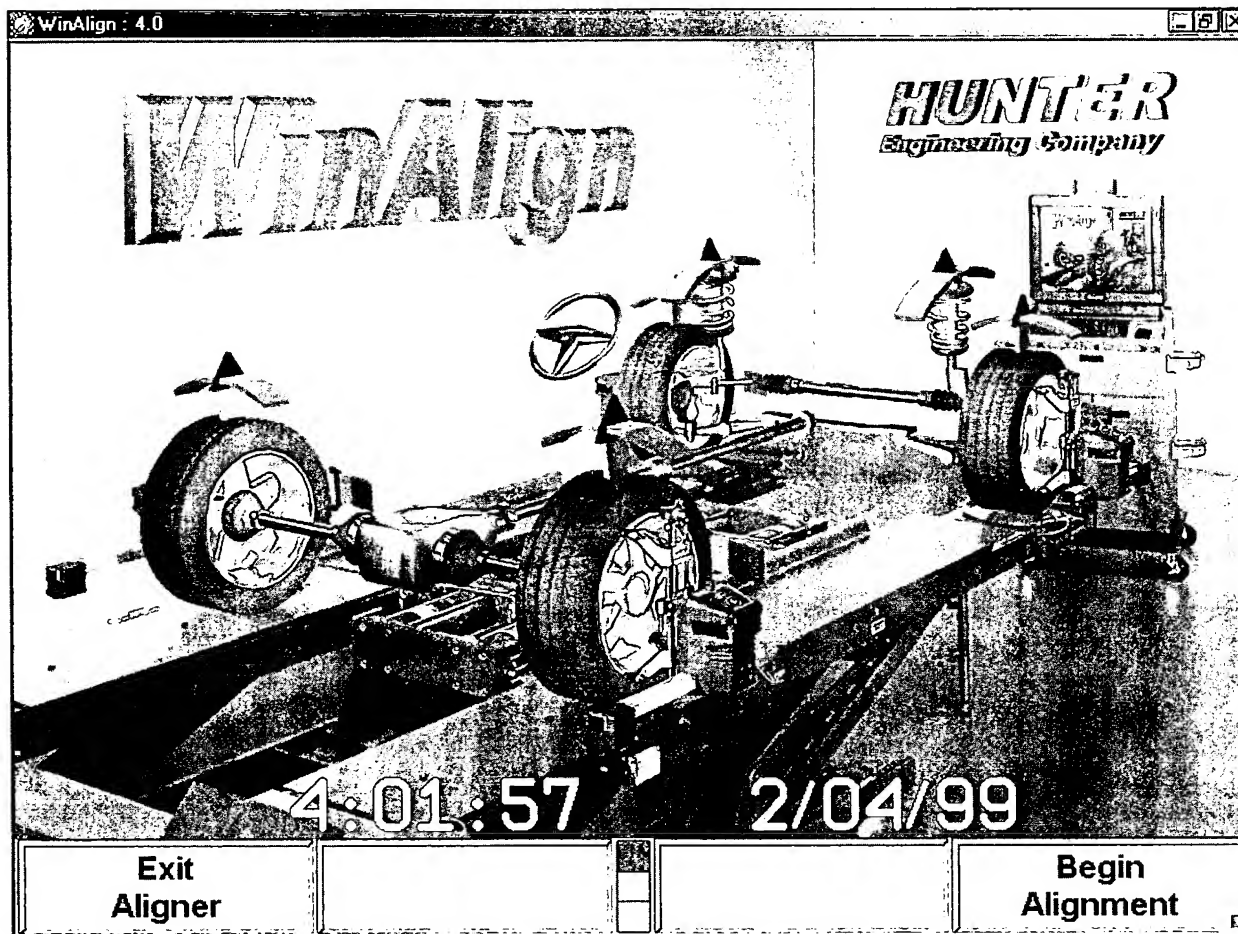
I hereby certify that this correspondence is being deposited with the U.S. Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on May 6, 2005.

Mark E. Books, Reg. No. 40,918

Date

WinAlign Quick Reference

Version 4.0



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Engineering Company

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An Example Alignment Job with ExpressAlign™ and DSP400 Sensors

The "Total-Four-Wheel" alignment procedure requires the use of all four sensors and is typically used when adjustments are available for rear camber and/or rear toe.

This example alignment job assumes that the system is configured as follows:

ENABLED	DISABLED
Edit Customer ID	Alignment Procedure Bar
Display of Vehicle Specifications	
Vehicle Inspection	
Show Measurements Display After Compensation	
Show Measurements Display After Caster	
Show Steering Wheel Status	
ExpressAlign Level III	
DSP400 Instructions	
Caster/SAI	

Your system may be configured differently.

NOTE: This section is an overview of an alignment job using ExpressAlign. For details about any procedure, refer to the appropriate section of the manual or press "HELP" in the WinAlign program.

From aligner setup, "DSP400 Sensors" must be selected as the default sensor. Refer to "Aligner Setup," page 61.

Prepare the vehicle for alignment as follows:

Drive the vehicle onto the alignment rack, centering the front wheels on the turnplates.

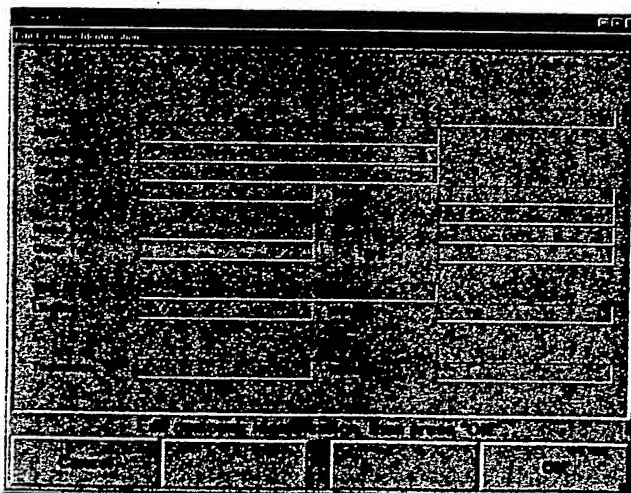
Apply the vehicle parking brake and place the transmission in park, if applicable. On standard transmission vehicles, the transmission should be placed in neutral.

Position chocks at the front and rear of the left rear tire to keep the vehicle from rolling.

Place the lift at alignment height.

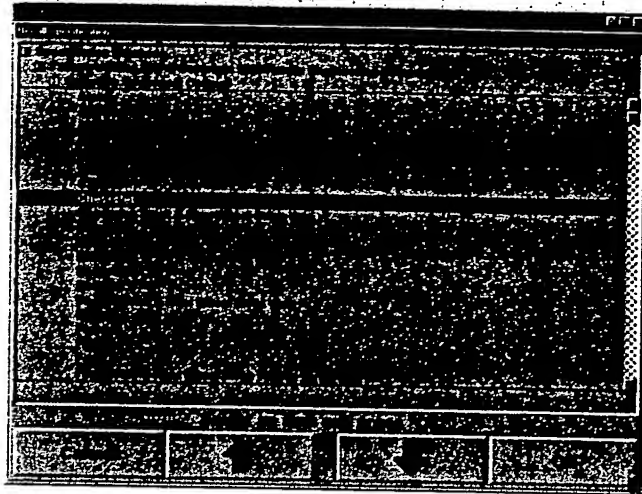
Check and adjust tire pressure to vehicle manufacturer's specification. Inspect for unevenly worn or mismatched tires.

Start the alignment program by pressing "Begin Alignment" on the "Logo" screen. The "Edit Customer Identification" popup screen will appear.



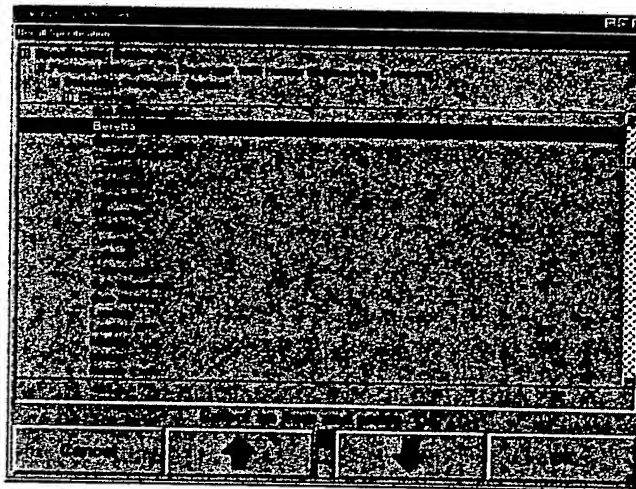
Enter customer information using the keyboard. Press "Tab" or "Enter" to move cursor to the next entry field, or press "Shift" and "Tab" to move the cursor to a previous field.

Press "OK" after entering the information, the "Recall Specifications" popup screen will appear.



Press "↑" or "↓" to highlight the manufacturer of the vehicle being aligned.

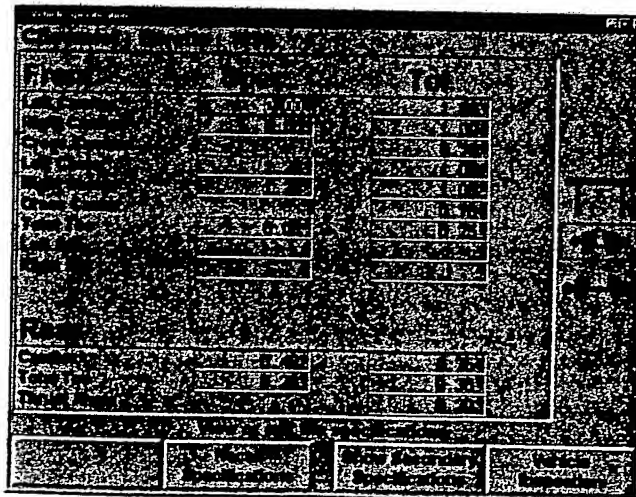
Press "OK" to select the highlighted manufacturer. The next screen will list the models available from the selected manufacturer.



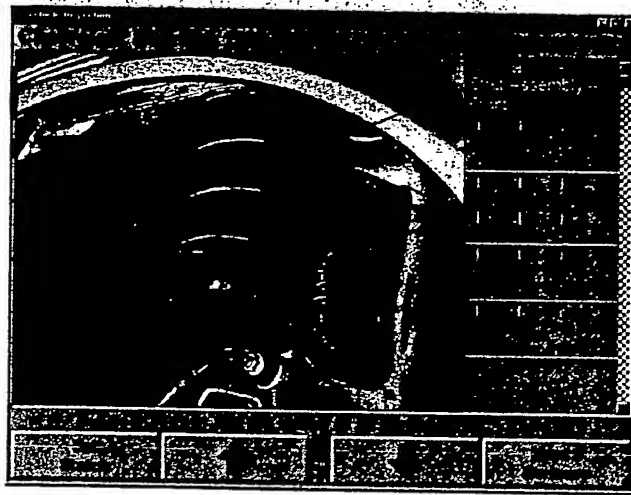
Press "↑" or "↓" to highlight the model of the vehicle being aligned.

Press "OK" to select that model.

Continue in this manner until the vehicle is identified to the program. The "Vehicle Specifications" primary screen displays the identification and alignment specifications for the vehicle chosen.



Confirm that the vehicle identified is the vehicle you have chosen and then press "Vehicle Inspection." The screen will change to the "Vehicle Inspection" popup screen.



The screen will display a photographic image or illustration in the beginning of the inspection. To the right of the picture, a scrollable inspection list is displayed.

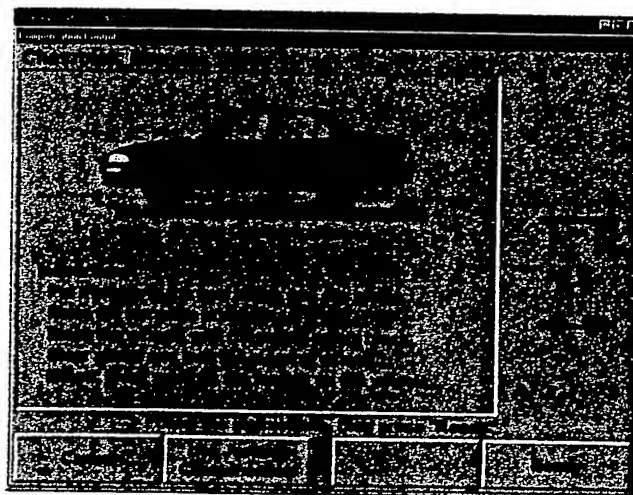
Inspect the suspension and steering linkage components for wear, looseness, or damage.

NOTE:	All worn or damaged components should be replaced prior to an alignment.
--------------	--

Press "Set Status" to set the status of an item that has been inspected. ("Item has been checked," "Suggest Replacement," or "Required Replacement"). Constant pressing of "Set Status" will continually move to the next condition of that part.

Press "↑" or "↓" to scroll to the next item on the list after the status has been set.

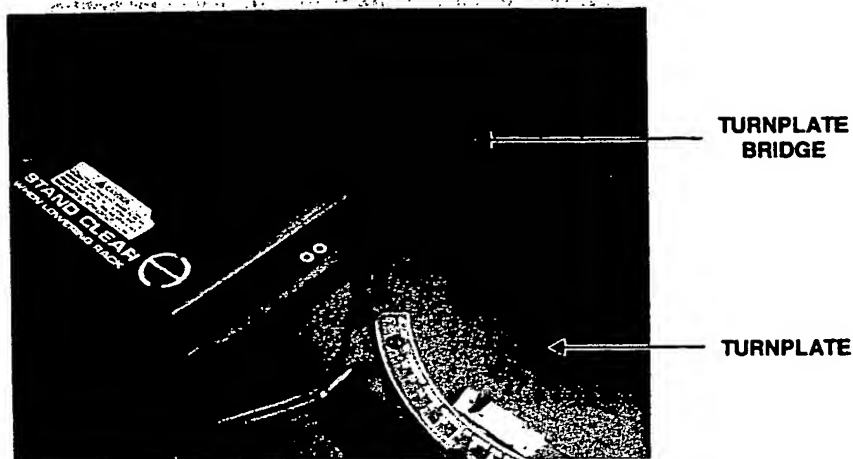
After completing the inspection, press "Mount Sensors." The screen will change to the "Compensation Control" popup screen.



There are two methods of compensation, rolling and jacking. The method chosen for this example procedure is rolling compensation.

Verify that the pins are in the turnplates and slip plates.

Raise the turnplate bridges.



Place wheel chocks that limit rearward motion approximately 15 inches behind rear wheel(s).

Steer ahead and lock the steering wheel.

Mount the targets and wheel adaptors on the wheels. *Refer to "Mounting Targets," 58.*

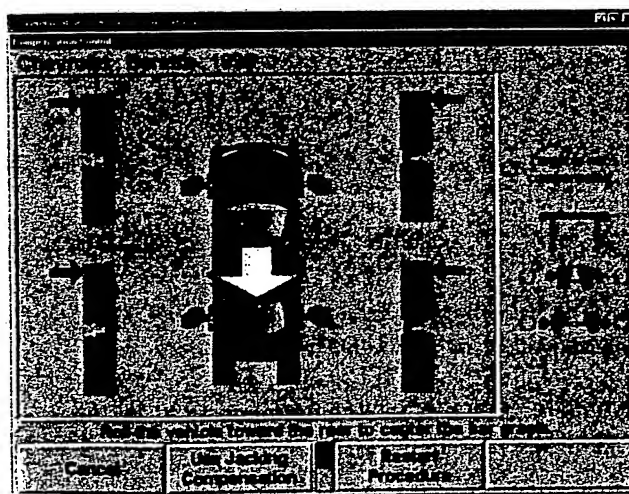
Level and lock the targets, then press "Ready." When the targets are stable, the measurements will be saved.

NOTE: Once the targets are leveled (for compensation), they should not be releveled at any time during the alignment. **The only exception being - If the target is removed from the wheel or adaptor during the alignment, (shim replacement, steering component replacement, etc.) the affected wheel must be releveled and recompensated, using jacking compensation.**

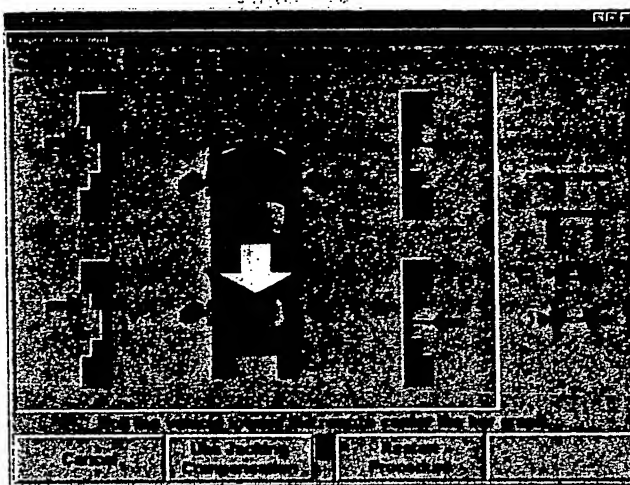
NOTE: Beginning the rolling compensation procedure removes any previous compensation from the targets.

The screen instructs you to roll the vehicle rearward. Release parking brake and put transmission in neutral. Roll the vehicle rearward until the bar graph turns green.

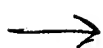
NOTE: It is recommended to roll the vehicle by rotating the left rear tire. Do not push or pull the vehicle by the front (steering axle) tires or wheels during rolling compensation. Do not push or pull on spoilers, fascia moldings, or other "trim" accessories.



NOTE: A vehicle with 28 inch diameter tires will require approximately 12 – 14 inches of movement. Smaller diameter tires will require less movement, while larger diameter tires will require more.

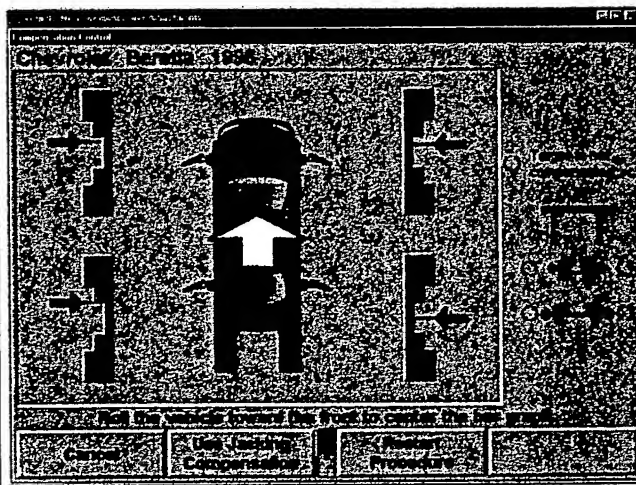
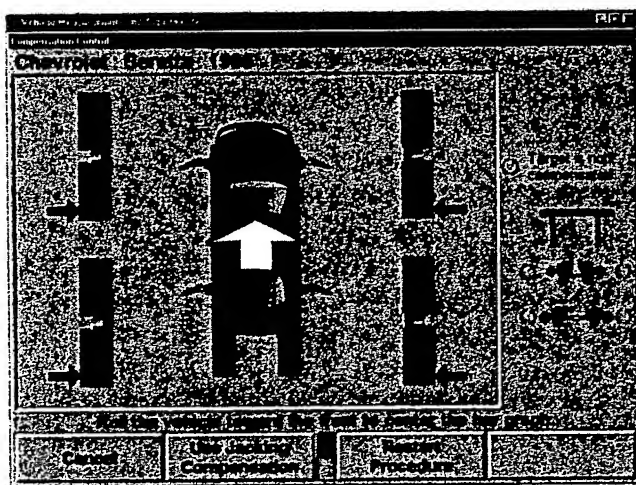


Stop rearward movement of the vehicle. The bar graph will disappear for a moment.



If a new style remote indicator is used, indicators for all four wheels will be flashing, indicating to roll forward.

When the compensation bar graph reappears, roll the vehicle forward to the original position.



When all four targets have been compensated, apply the vehicle parking brake and place the transmission in park, if applicable. On standard transmission vehicles, the transmission should be placed in neutral.

Block the wheels.

NOTE: The rolling compensation procedure **MUST** end with the vehicle in the proper position to check and adjust the alignment. The wheels are **NOT** allowed to rotate after the procedure is performed.

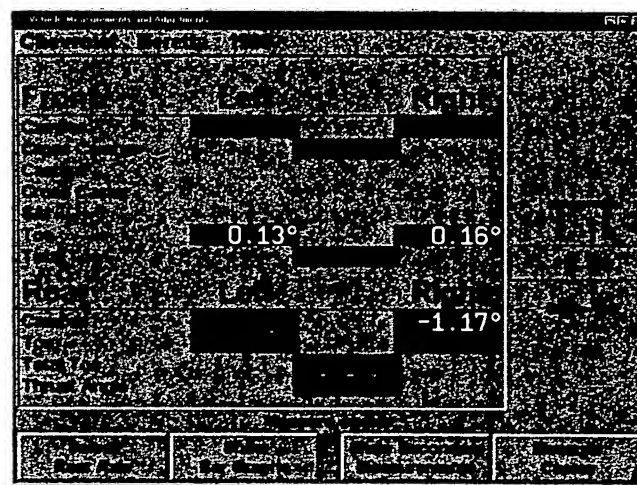
After the targets have been compensated, the "Compensation Control" popup screen will give further instructions on how to perform the alignment procedure.



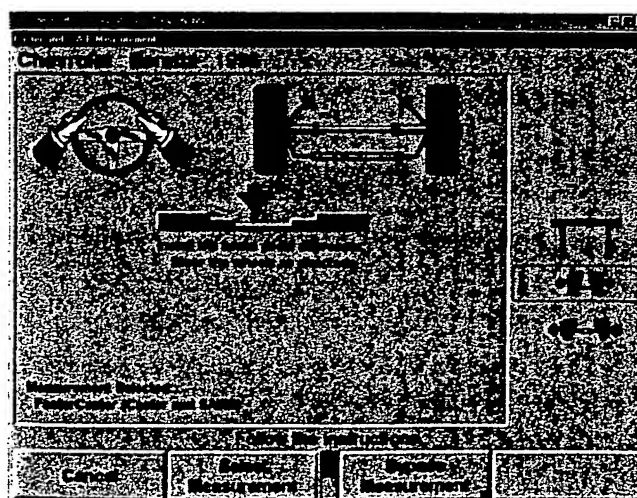
Remove the pins from the turnplates, and slip plates.

Lower the turnplate bridges.

The screen will change to the "Vehicle Measurements and Adjustments" primary screen. Alignment measurements for the current vehicle are shown on this screen.

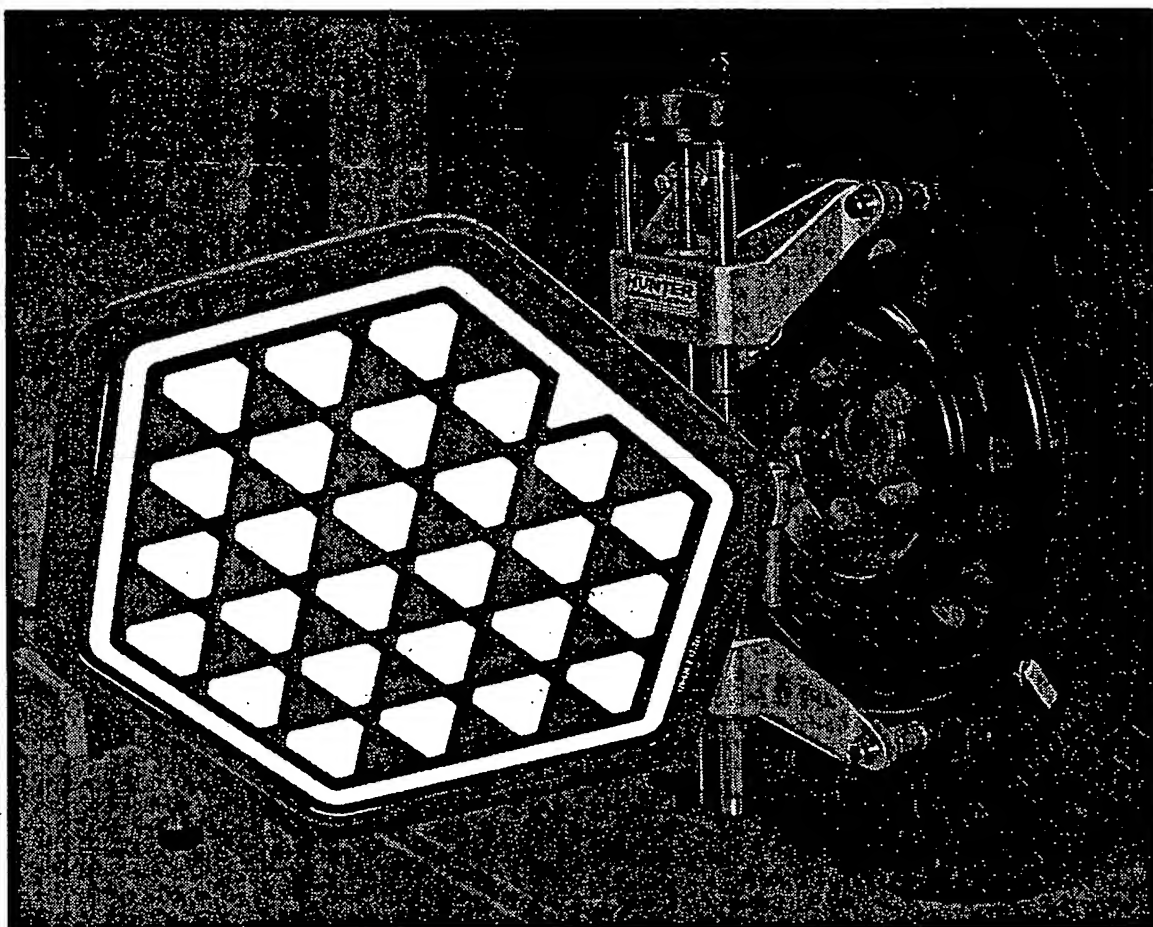


Press "Measure Caster." The screen will change to the "Caster and S.A.I. Measurement" popup screen, which will direct you to measure caster and S.A.I.



OPERATION INSTRUCTIONS

DSP400 Series Sensors



HUNTER
Engineering Company

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1. Getting Started

1.1 About This Manual

This manual contains important operation, maintenance, and safety information for DSP400 Series Sensors. It is supplemented by the WinAlign® Quick Reference, Form 4307T, supplied with the 411 Alignment System Console, or the on-line Help File. Read and become familiar with the contents of these publications.

The owner of the aligner is solely responsible for arranging technical training. Only a qualified trained technician should operate the aligner. Maintaining records of personnel trained is solely the responsibility of the owner and management.

"References"


This manual assumes you are already familiar with the basics of wheel alignment. *"Italics"* are used to refer to specific parts of this manual that provide additional information or explanation. For example, *Refer to "Equipment Components," page 5.* These references should be read for additional information to the instructions being presented.

NOTE:	DSP400 Series Sensors are for use only with WinAlign® 3.0.2 software or higher.
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1.2 For Your Safety

Hazard Definitions

Watch for these symbols:

 CAUTION:	Hazards or unsafe practices, which could result in minor personal injury or product and/or property damage.
---	---

 WARNING:	Hazards or unsafe practices, which could result in severe personal injury or death.
---	---

 DANGER:	Immediate hazards, which will result in severe personal injury or death.
--	--

These symbols identify situations that could be detrimental to your safety and/or cause equipment damage.

IMPORTANT SAFETY INSTRUCTIONS

Read and follow all caution and warning labels affixed to your equipment and tools. Misuse of this equipment can cause personal injury and shorten the life of the aligner.

Always use wheel chocks in front of and behind the left rear wheel after positioning a vehicle on the rack.

Use caution when jacking the vehicle up or down.

ALWAYS WEAR OSHA APPROVED SAFETY GLASSES. Eyeglasses that have only impact resistant lenses are **NOT** safety glasses.

Wear non-slip safety footwear when performing an alignment.

Never stand on the aligner.

Do not wear jewelry or loose clothing when performing an alignment.

Wear proper back support when lifting or removing wheels.

Keep all instructions permanently with the unit.

Keep all decals, labels, and notices clean and visible.

Misusing this equipment can shorten the life of the equipment. To prevent accidents and/or damage to the sensors, use only Hunter recommended accessories.

Use equipment only as described in this manual.

Remove the targets from the wheels before moving the vehicle (except during rolling compensation). *Refer to "Rolling Compensation," page 25.*

When targets and wheel adaptors are not in use, store them in the sensor supports.

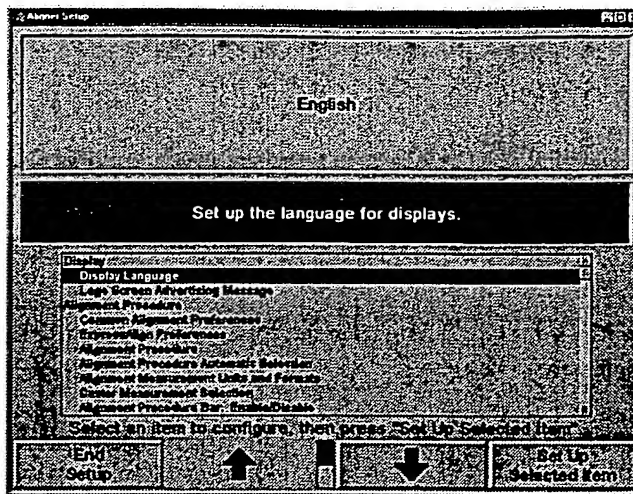
1.3 Aligner Setup

The aligner can be configured to meet many different operating needs. For example, the "Customer Identification" screen can be removed from the prompt sequence so it does not automatically appear at the beginning of the alignment process, but is still accessible through the menu selection. Other selections such as the default alignment procedure can be set.

The setup selections are stored on the hard drive and recalled each time that the program needs them.

To modify setup, press "Service Programs" on the logo screen. The menu labels will change.

Press "Set Up Aligner" and the "Aligner Setup" primary screen will appear.



The "Aligner Setup" primary screen provides a list box of set up items. Press "↑" or "↓" to highlight the desired selection. When an item is highlighted, the current setting appears on the screen, along with an explanation of the item. Press "Set Up Selected Item" to open the popup screen to setup the highlighted item.

To move from one major heading to another, press "↑↑" or "↓↓" from the second tier of softkeys.

Press "End Setup" after all the desired changes have been made to exit setup and save changes.

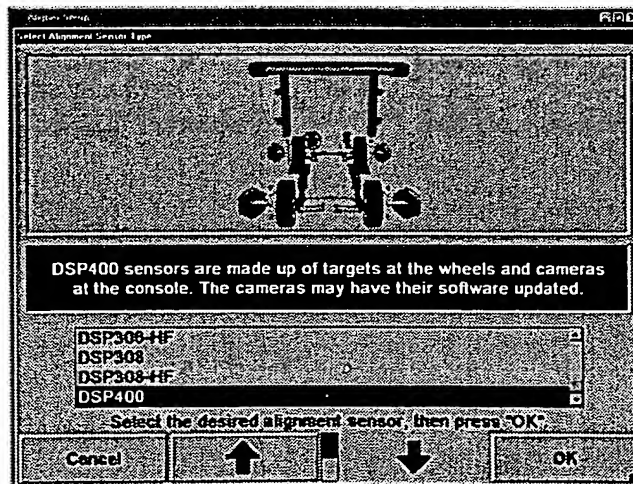
NOTE:

After technicians have been trained and are comfortable with using DSP400 Sensors, to streamline the alignment procedure, it is recommended that the aligner setup feature for "DSP Instructions" be disabled.

Setting Up the Sensor Type

When "Sensor Type" is selected, the "Select Alignment Sensor Type" popup screen will appear.

Press "↑" or "↓" until the "DSP400" sensors are highlighted.

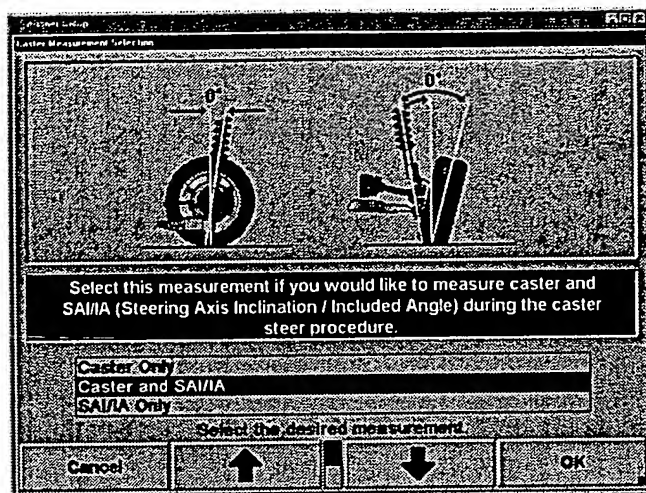


Press "OK" to set the default to the highlighted sensor type. The program stores this information on the hard drive and returns to the "Aligner Setup" primary screen.

Setting Up the Caster Measurement Selection

When "Caster Measurement Selection" is selected, the "Caster Measurement Selection" popup screen will appear.

This selection will setup the aligner program to measure caster only, caster and SAI/IA, or SAI/IA only as the default.

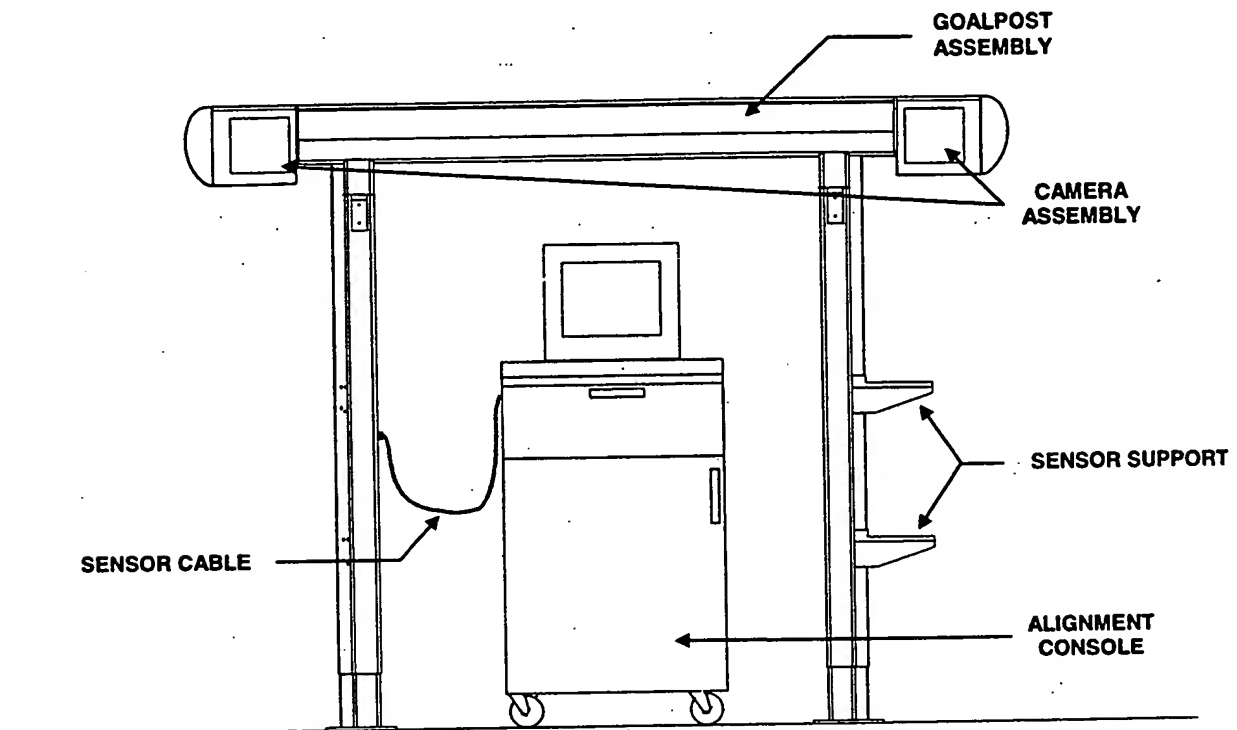


Press "↑" or "↓" until "Caster and SAI/IA" is highlighted.

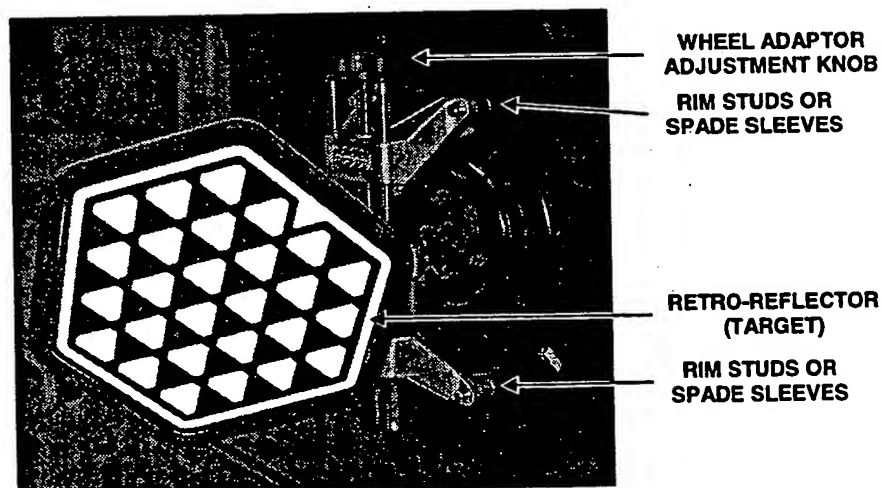
Press "OK" to set the default to the highlighted measurement selection. The program stores this information on the hard drive and returns to the "Aligner Setup" primary screen.

1.4 Equipment Components

The DSP400 Sensors are made up of two basic components. One component is the goalpost assembly, which houses the camera assemblies and provides adaptor storage. Cameras on the right side of the goalpost are connected to the cameras on the left side within the structure itself. The alignment console connects to the goalpost through a standard sensor cable that plugs into the goalpost. The second component is the target and wheel adaptor assemblies, which are referred to as "retro-reflectors" or "targets."



GOALPOST AND CAMERA



TARGET AND WHEEL ADAPTOR

1.5 Camera

The camera assemblies communicate with the alignment console using a standard sensor cable. As the cameras flash, they are transmitting an infrared light that illuminates the retro-reflectors (targets). The infrared light is then reflected back to the cameras. This infrared light signals processors in the cameras, providing them with location and orientation data of the targets. New measurements are taken each time the cameras flash. With the information generated by the digital signal processors, the measurement angles of caster, camber and toe are determined.

1.6 An Example Alignment Job with ExpressAlign™ and DSP400 Sensors

The "Total Four-Wheel" alignment procedure requires the use of all four sensors and is typically used when adjustments are available for rear camber and/or rear toe.

This example alignment job assumes that the system is configured as follows:

ENABLED	DISABLED
Edit Customer ID	Alignment Procedure Bar
Display of Vehicle Specifications	
Vehicle Inspection	
Show Measurements Display After Compensation	
Show Measurements Display After Caster	
ExpressAlign Level III	

Your system may be configured differently.

NOTE: This section is an overview of an alignment job using ExpressAlign. For details about any procedure, *refer to the appropriate section of the manual or press "HELP" in the WinAlign program.*

From aligner setup, "DSP400 Sensors" must be selected as the default sensor. *Refer to "Aligner Setup," page 2.*

Prepare the vehicle for alignment as follows:

Drive the vehicle onto the alignment rack, centering the front wheels on the turnplates.

Apply the vehicle parking brake and place the transmission in park, if applicable. On standard transmission vehicles, the transmission should be placed in neutral.

Position chocks at the front and rear of the left rear tire to keep the vehicle from rolling.

Place the lift at alignment height.

Check and adjust tire pressure to vehicle manufacturer's specification. Inspect for unevenly worn or mismatched tires.

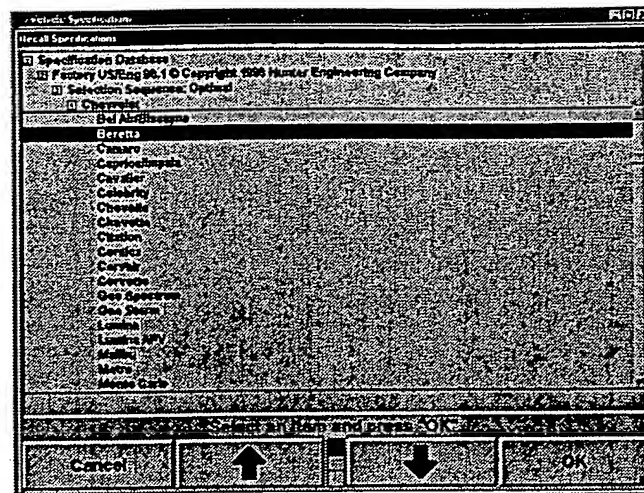
Start the alignment program by pressing "Begin Alignment" on the "Logo" screen. The "Edit Customer Identification" popup screen will appear.

Enter customer information using the keyboard. Press "Tab" or "Enter" to move cursor to the next entry field, or press "Shift" and "Tab" to move the cursor to a previous field.

Press "OK" after entering the information, the "Recall Specifications" popup screen will appear.

Press "↑" or "↓" to highlight the manufacturer of the vehicle being aligned.

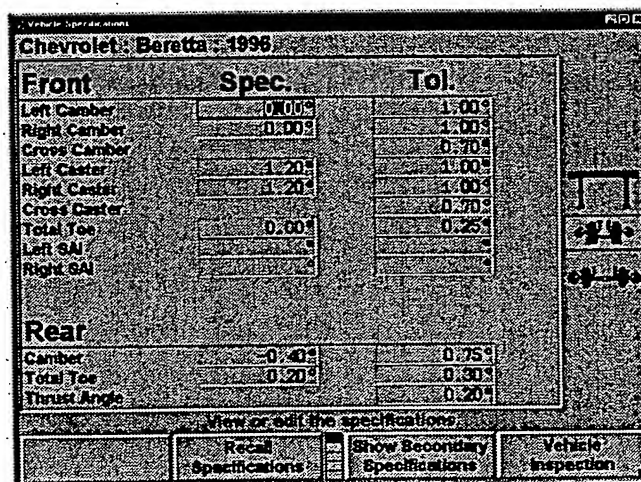
Press "OK" to select the highlighted manufacturer. The next screen will list the models available from the selected manufacturer.



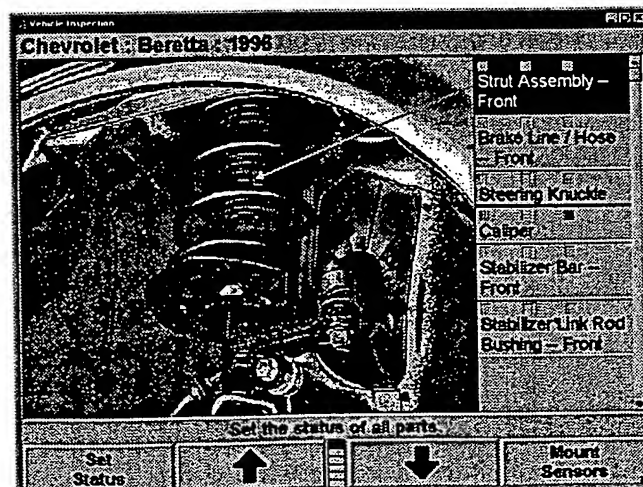
Press "↑" or "↓" to highlight the model of the vehicle being aligned.

Press "OK" to select that model.

Continue in this manner until the vehicle is identified to the program. The "Vehicle Specifications" primary screen displays the identification and alignment specifications for the vehicle chosen.



Confirm that the vehicle identified is the vehicle you have chosen and then press "Vehicle Inspection." The screen will change to the "Vehicle Inspection" popup screen.



The screen will display a photographic image or illustration in the beginning of the inspection. To the right of the picture, a scrollable inspection list is displayed.

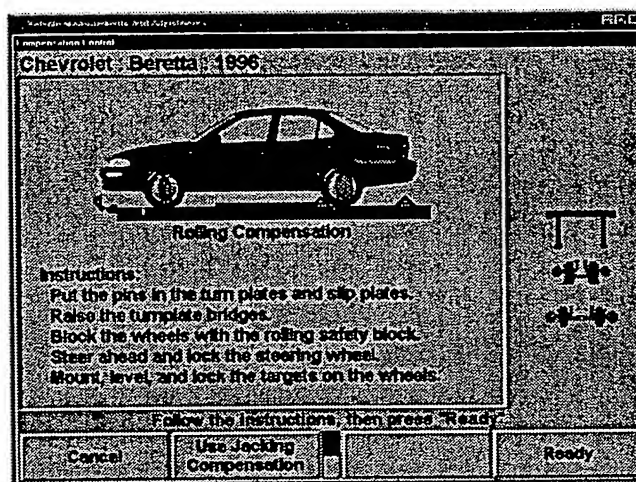
Inspect the suspension and steering linkage components for wear, looseness, or damage.

NOTE: All worn or damaged components should be replaced prior to an alignment.

Press "Set Status" to set the status of an item that has been inspected. ("Item has been checked," "Suggest Replacement," or "Required Replacement"). Constant pressing of "Set Status" will continually move to the next condition of that part.

Press "↑" or "↓" to scroll to the next item on the list after the status has been set.

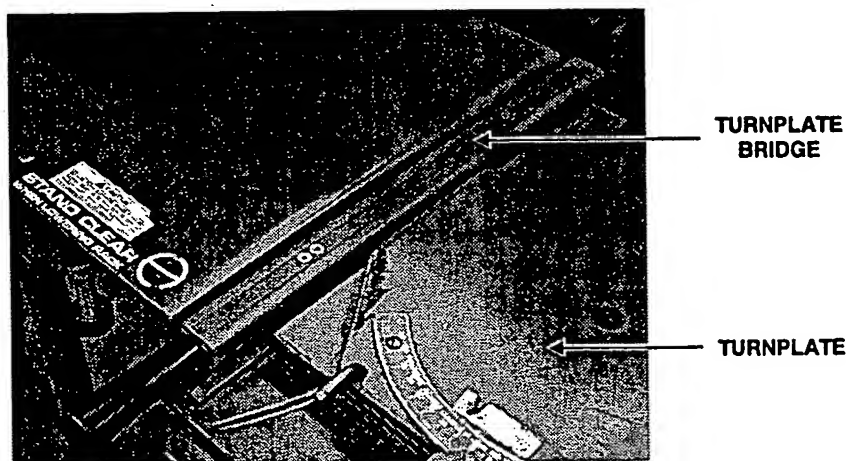
After completing the inspection, press "Mount Sensors." The screen will change to the "Compensation Control" popup screen.



There are two methods of compensation, rolling and jacking. The method chosen for this example procedure is rolling compensation. Refer to "Rolling Compensation," page 25, or to "Jacking Compensation," page 30.

Verify that the pins are in the turnplates and slip plates.

Raise the turnplate bridges.



Place wheel chocks that limit rearward motion approximately 15 inches behind rear wheel(s).

Steer ahead and lock the steering wheel.

Mount the targets and wheel adaptors on the wheels. *Refer to "Mounting Targets," page 21.*

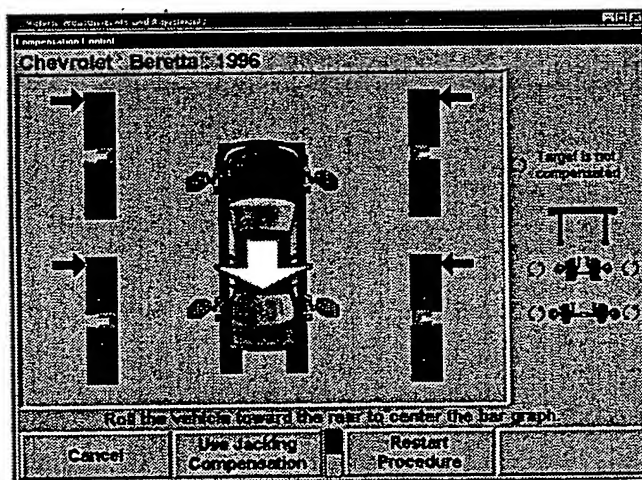
Level and lock the targets, then press "Ready." When the targets are stable, the measurements will be saved.

NOTE: Once the targets are leveled (for compensation), they should not be releveled at any time during the alignment. **If the target is removed from the wheel or adaptor during the alignment, it must be releveled and recompensated, using jacking compensation.**

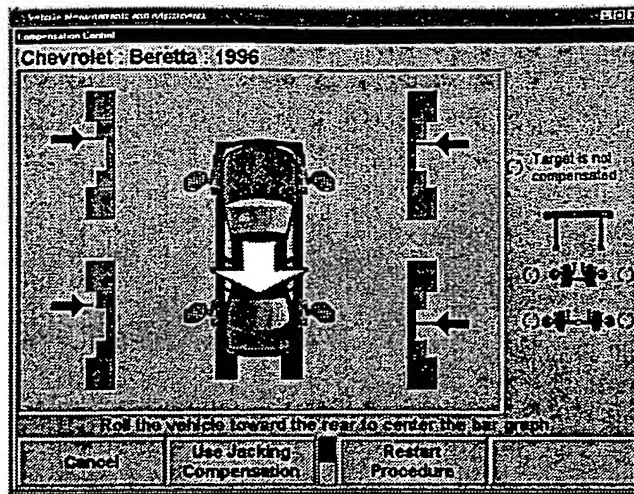
NOTE: Beginning the rolling compensation procedure removes any previous compensation from the targets.

The screen instructs you to roll the vehicle rearward. Release parking brake and put transmission in neutral. Roll the vehicle rearward until the bar graph turns green.

NOTE: It is recommended to roll the vehicle by rotating the left rear tire. Do not push or pull the vehicle by the front (steering axle) tires or wheels during rolling compensation. Do not push or pull on spoilers, fascia moldings, or other "trim" accessories.



NOTE: A vehicle with 28 inch diameter tires will require approximately 12 – 14 inches of movement. Smaller diameter tires will require less movement, while larger diameter tires will require more.

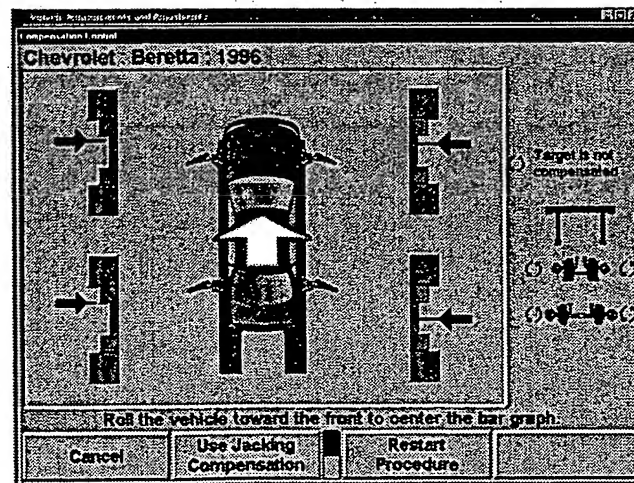
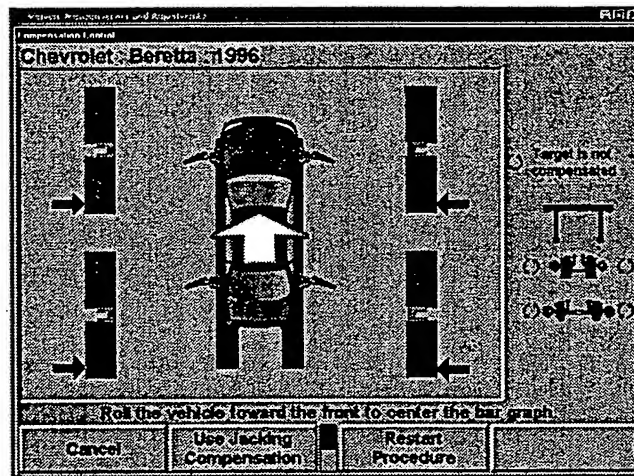


Stop rearward movement of the vehicle. The bar graph will disappear for a moment.



If a remote indicator is used, indicators for all four wheels will be flashing, indicating to roll forward.

When the compensation bar graph reappears, roll the vehicle forward to the original position.



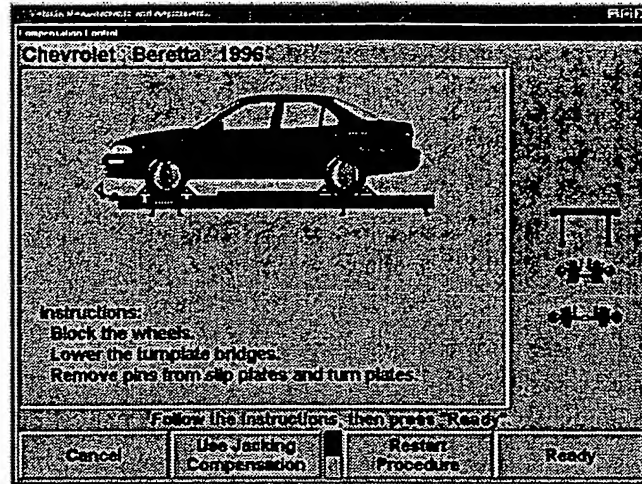
When all four targets have been compensated, apply the vehicle parking brake and place the transmission in park, if applicable. On standard transmission vehicles, the transmission should be placed in neutral.

Block the wheels.

NOTE:

The rolling compensation procedure **MUST** end with the vehicle in the proper position to check and adjust the alignment. The wheels are **NOT** allowed to rotate after the procedure is performed.

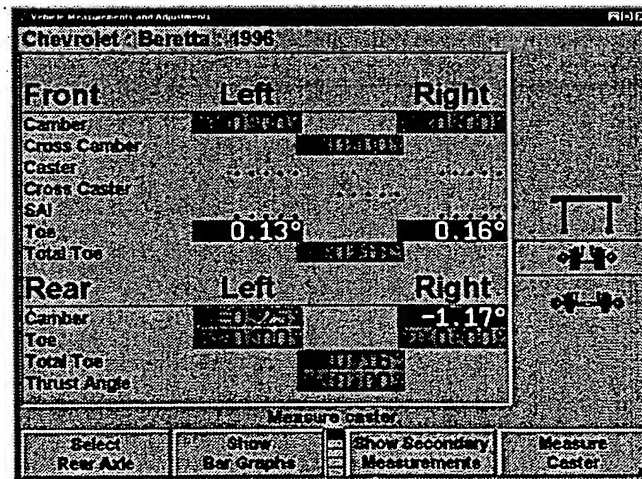
After the targets have been compensated, the "Compensation Control" popup screen will appear.



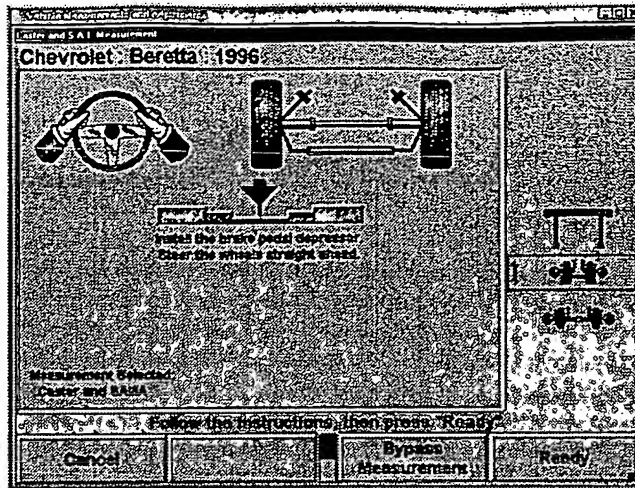
Remove the pins from the turnplates, and slip plates.

Lower the turnplate bridges.

The screen will change to the "Vehicle Measurements and Adjustments" primary screen. Alignment measurements for the current vehicle are shown on this screen.

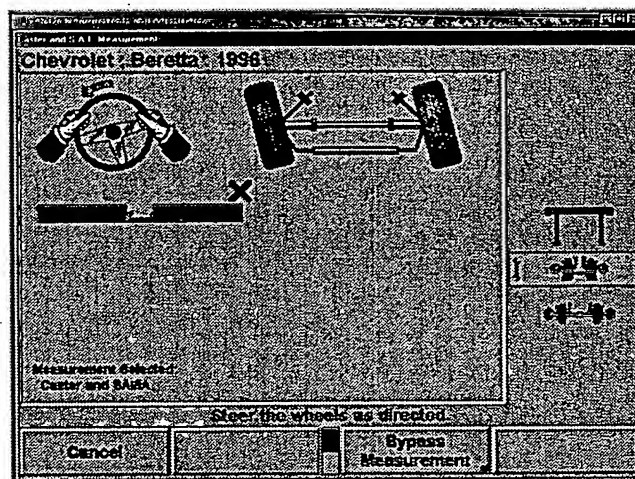


Press "Measure Caster." The screen will change to the "Caster and S.A.I. Measurement" popup screen, which will direct you to measure caster and S.A.I.

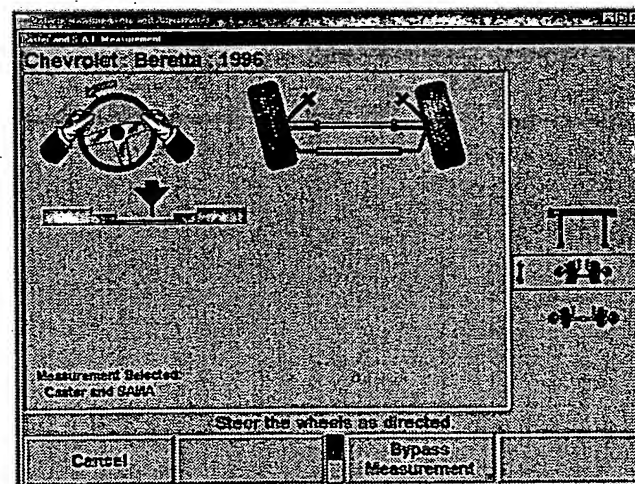


Install the brake pedal depressor. Steer the wheels straight ahead, then press "Ready."

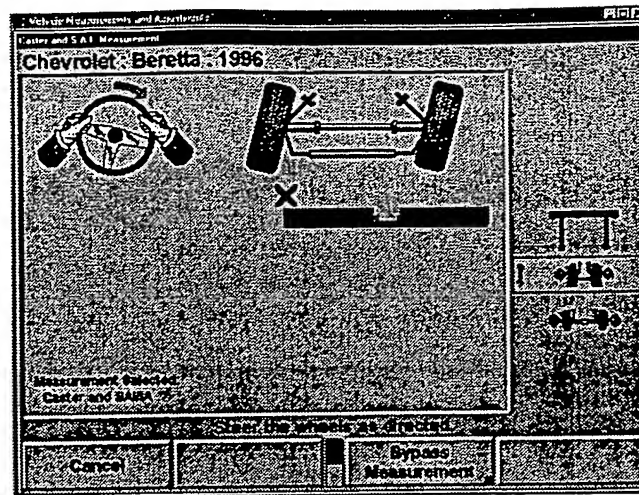
Steer the wheels as directed and follow the on-screen directions.



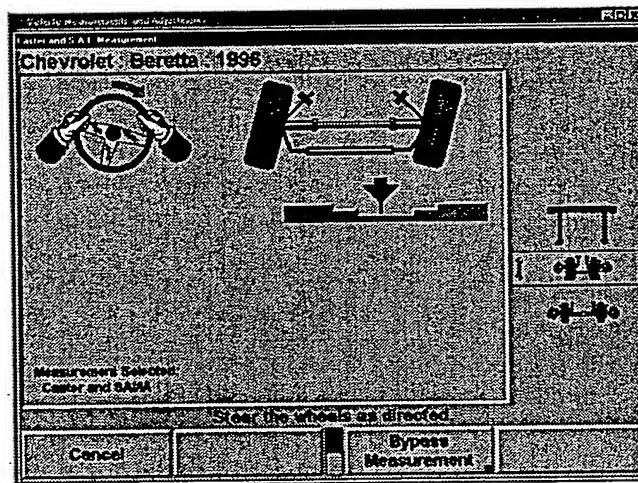
Continue steering until the bar graph turns green.



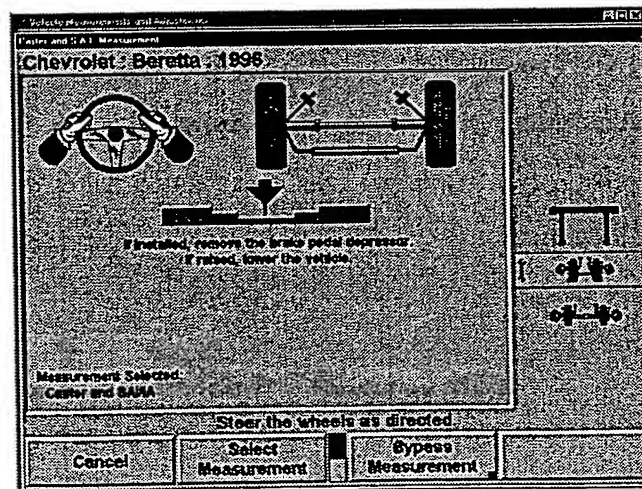
When directed, begin steering in the opposite direction.



Continue steering until the bar graph turns green.

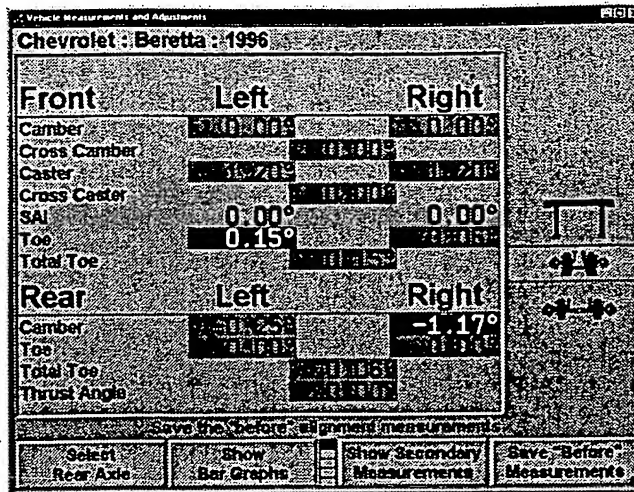


After caster has been measured, the screen prompts you to steer the wheels straight ahead. If installed, remove the brake pedal depressor.



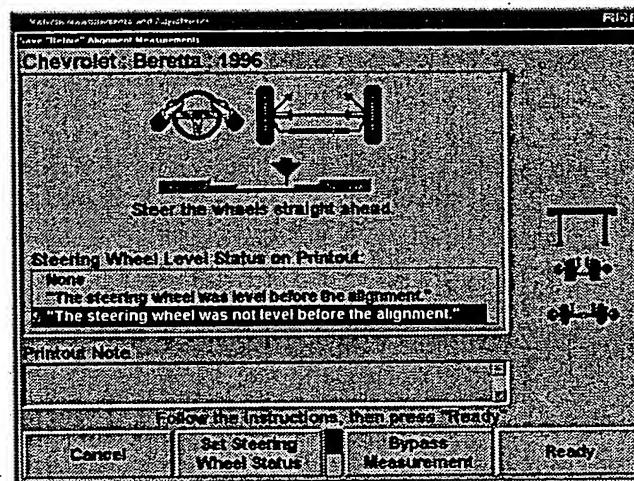
If raised, lower the vehicle.

Press "Bypass Measurement" and the "Vehicle Measurements and Adjustments" primary screen will appear.



These are the initial measurements of the vehicle. Press "Save 'Before' Measurements" to save them for the printout.

The screen will change to the "Save 'Before' Alignment Measurements" popup screen.

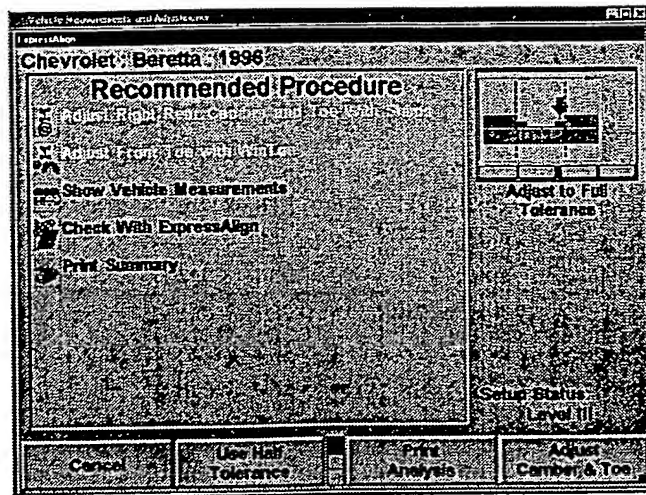


Make sure the vehicle is in the correct condition to save the "Before" measurements. Steer the wheels straight ahead until the bar graph turns green.

For printouts, highlight the steering wheel level status. This message will be displayed on printouts and be used by "ExpressAlign™" to determine if WinAlign should be run.

Press "Ready." When the measurements are stable, they will be saved by the program for printout.

The screen will change to the "ExpressAlign" popup screen.



NOTE:

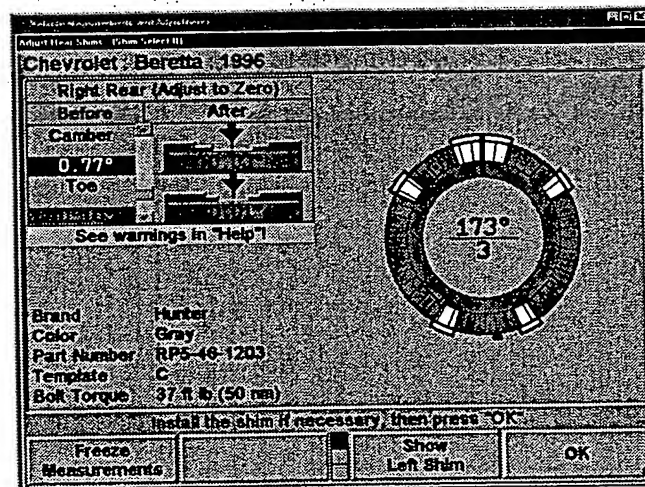
The actual procedures displayed will vary depending on the vehicle and alignment angles that need to be adjusted.

An icon will be displayed in the "ExpressAlign" popup screen for each suggested procedure. Selecting an icon from the "ExpressAlign" popup screen will start the procedure that the icon represents.

Procedures that have yellow text in the "ExpressAlign" popup screen refer to adjustments that must be made for the specified vehicle.

Selecting the "K4" softkey in ExpressAlign will prompt you through the recommended sequence for the alignment. In this instance, the right rear camber and toe will be the first necessary adjustment.

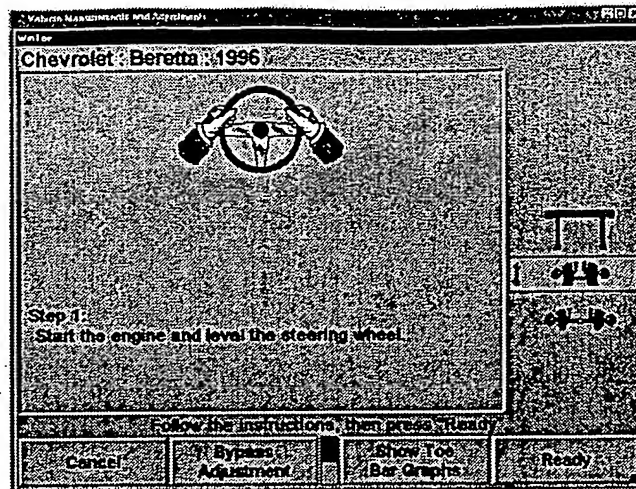
This vehicle uses shims to adjust rear camber and toe. Selecting "Adjust Camber & Toe" will automatically proceed to Shim Select II[®] and display the correct shim for the necessary adjustment.



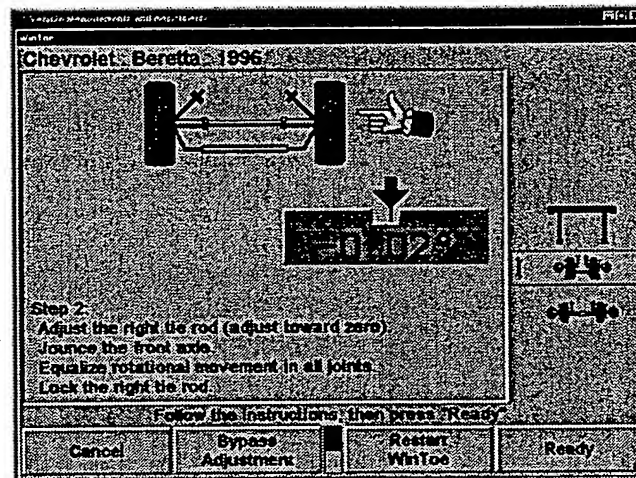
If the vehicle you are aligning does not use shims, ExpressAlign will select and display the appropriate adjustment screen.

Remove the target and wheel adaptor to install shim. After installing shim and replacing target, the target must be recompensated using jacking compensation. Refer to "Jacking Compensation," page 30.

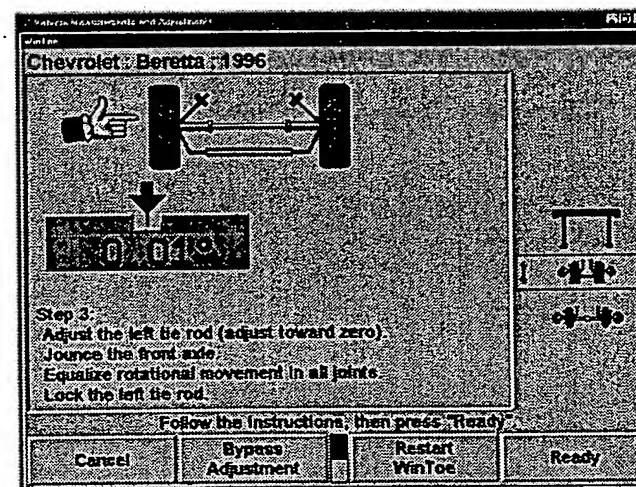
Start the engine and level the steering wheel. Then press "Ready."



Make the adjustments indicated on the screen. Then press "Ready."



Make the adjustments indicated on the screen. Then press "Ready."



When adjustments are completed, press "Ready."

2. Mounting Targets

2.1 Mounting Targets onto Wheel Adaptors

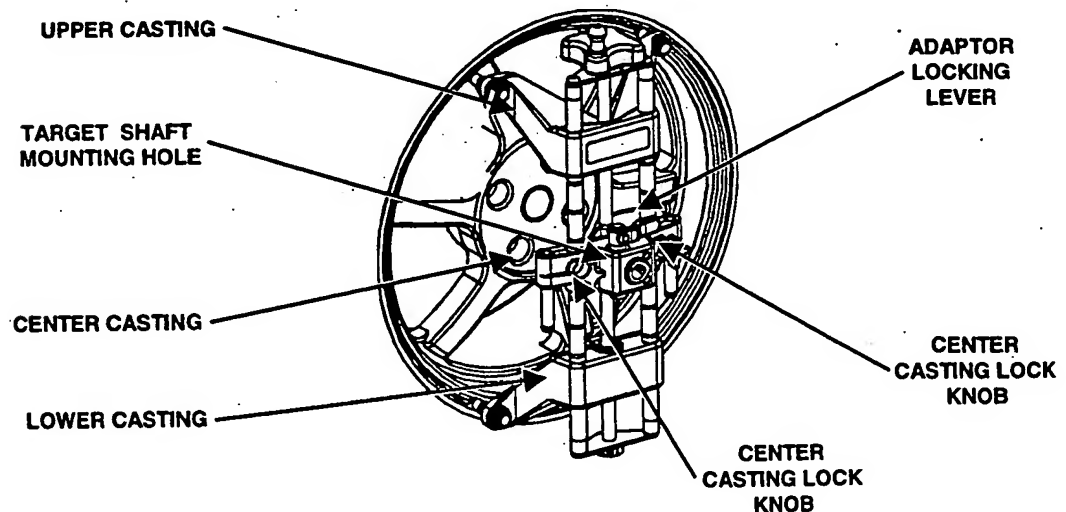
Targets may be mounted on the wheel adaptors before mounting the wheel adaptors on the vehicle. In some cases, it may be easier to mount the wheel adaptor first and then mount the target onto the adaptor. Either method may be used.

Center the wheel adaptor center casting between the upper and lower castings. When the center casting is properly centered, a plunger ball will fall into the detent position on the adaptor rod.

Tighten both center casting lock knobs firmly. This will prevent the center casting from slipping down when the target is attached.

CAUTION: Hand tighten center casting lock knobs as tight as possible. **DO NOT USE TOOLS TO TIGHTEN.**

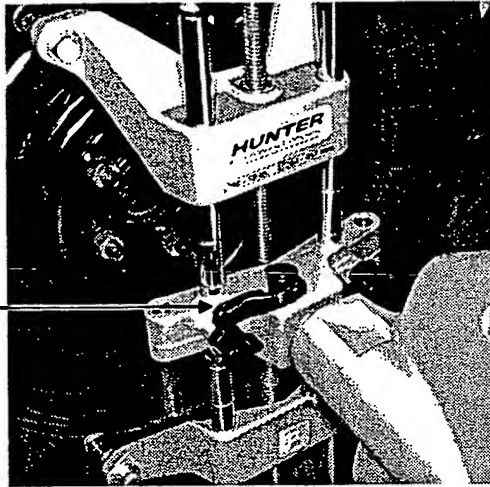
CAUTION: If the center casting lock knobs are not firmly tightened, runout compensation and alignment accuracy could be adversely affected.



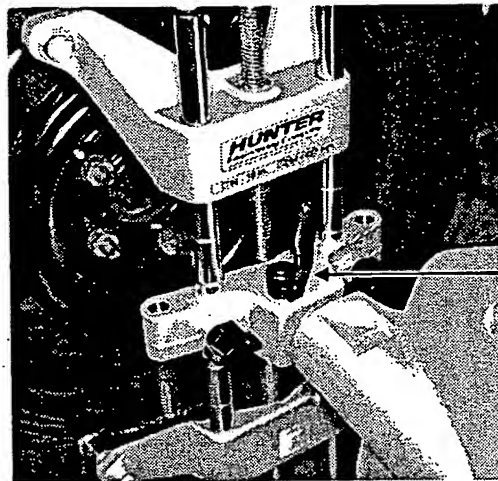
If detached, attach the target to the wheel adaptor by inserting the target mounting shaft into the target shaft mounting hole in the middle of the center casting.

NOTE: The target shaft should be fully inserted into the target shaft mounting hole.

**ADAPTOR LEVER
UNLOCKED
POSITION**



Rotate the adaptor-locking lever **clockwise** to the locked position.



**ADAPTOR LEVER
LOCKED
POSITION**

⚠ CAUTION: When mounting targets to the wheel adaptors, the target shaft should be fully seated. Make certain that there is no play or looseness between the target shaft and the wheel adaptor. Rotate the wheel while holding the target. Listen and feel for movement between the target and wheel adaptor. Runout compensation and alignment accuracy could be adversely affected if there is any movement between the target and wheel adaptor. Targets must fit tightly against the surface of the wheel adaptor or the lock may not hold.

When the target is mounted, the target-locking lever should be rotated using firm hand pressure. Tools should not be used to force the locking lever. If the lever can be rotated until it contacts the casting, yet is not fully locked, the locking lever should be adjusted. Refer to "Adjusting Wheel Adaptor Lock Lever," page 33.

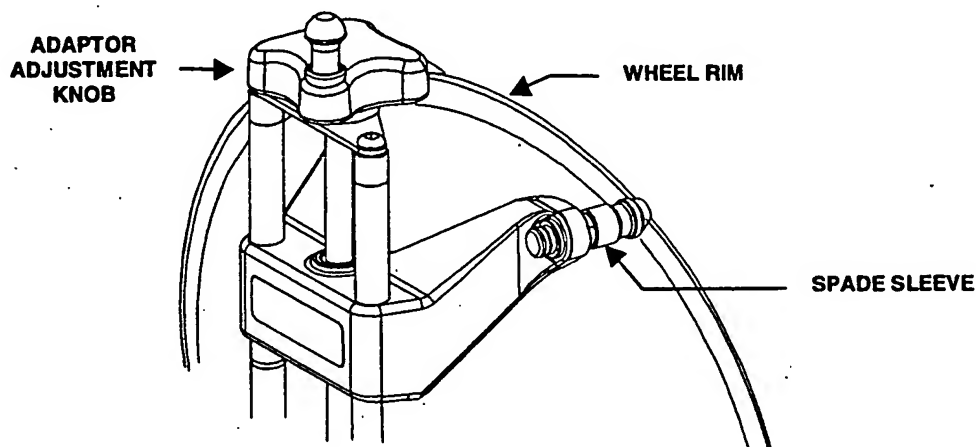
2.2 Mounting Wheel Adaptors onto Wheels

Wheels with No Rim Lip (Attaching to Outer Rim)

Position the wheel adaptor with the two upper spade sleeves on the outside of the wheel rim.

Align the two lower spade sleeves on the outside of the wheel rim, and check that all four spade sleeves will engage the outside of the wheel rim.

Turn the adaptor adjustment knob to firmly attach the adaptor to the wheel.



Test the security of the installation by lightly tugging on the wheel adaptor.

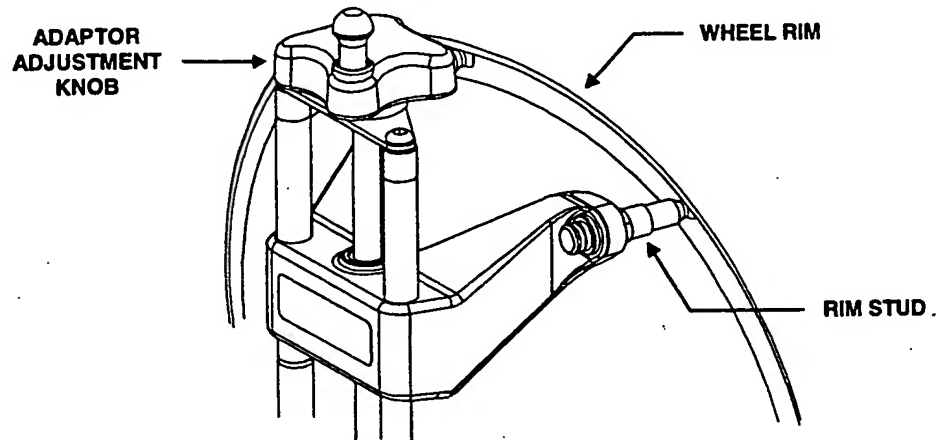
⚠ CAUTION: Do not allow the spade sleeves to slip on the wheel. Runout compensation and alignment accuracy will be adversely affected if the wheel adaptor is allowed to slip on the wheel.

Wheels with Rim Lip (Attaching to Inner Rim Lip)

Position the wheel adaptor with the two lower rim studs engaging the lower wheel rim lip.

Align the two upper rim studs with the upper wheel rim lip and check that all four studs will engage the inner portion of the rim lip.

Turn the adaptor adjustment knob to firmly attach the adaptor to the wheel.



Test the security of the installation by tugging on the wheel adaptor.

⚠ CAUTION: Do not use rim studs on alloy or clearcoated wheels. Rim studs can damage these wheels.

⚠ CAUTION: Do not allow the rim studs to slip on the wheel. Runout compensation and alignment accuracy could be adversely affected if the wheel adaptor is allowed to slip on the wheel.

3. Compensating

3.1 General Compensation

The targets must be compensated to eliminate errors in angle measurements caused by runout of the wheel, wheel adaptor, and target shaft.

The default setting for the alignment console can be set for either rolling or jacking compensation.

When using Jacking Compensation, refer to "Jacking Compensation," page 30, targets may be compensated in any order; however, these precautions must be followed:

If a target is removed from a wheel, that target must be recompensated when reinstalled. The other targets do not need recompensation.

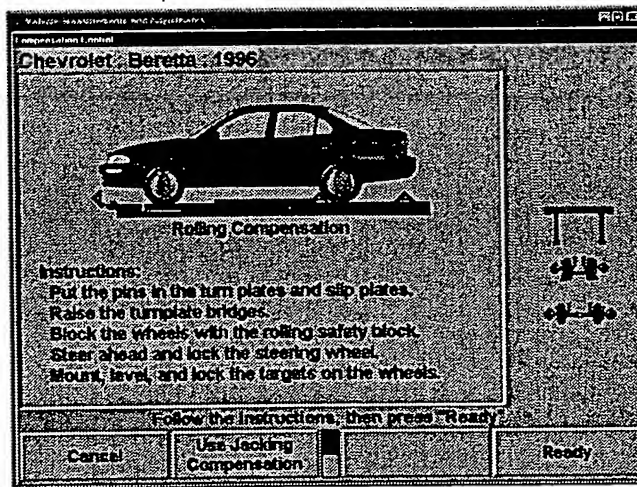
When compensating targets that are mounted to the vehicle drive wheels, place the transmission in NEUTRAL.

The lift rack should be level on the leveling legs.

The lock pins must be in place on the turnplates and rear slip plates during all rolling target compensation.

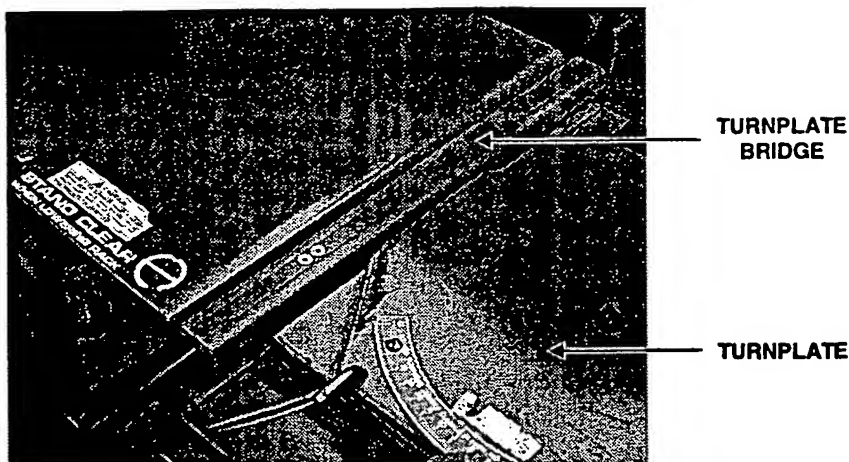
3.2 Rolling Compensation

From the "Compensation Control" popup screen, press "Use Rolling Compensation." The "Rolling Compensation" popup screen will appear.



Verify that the pins are in the turnplates and slip plates.

Raise the turnplate bridges.



Place wheel chocks that limit rearward motion approximately 15 inches behind rear wheel(s).

Steer ahead and lock the steering wheel.

Mount the targets and wheel adaptors on the wheels. *Refer to "Mounting Targets," page 21.*

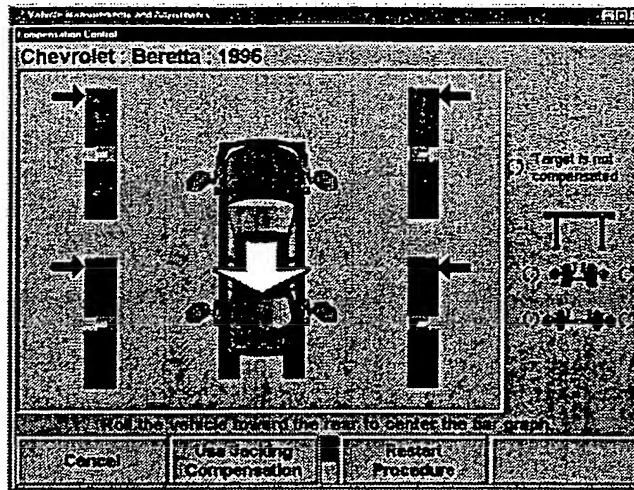
Level and lock the targets, then press "Ready." When the targets are stable, the measurements will be saved.

NOTE: Once the targets are leveled (for compensation), they should not be releveled at any time during the alignment. **If the target is removed from the wheel or adaptor during the alignment, it must be releveled and recompensated, using jacking compensation.**

NOTE: Beginning the rolling compensation procedure removes any previous compensation from the targets.

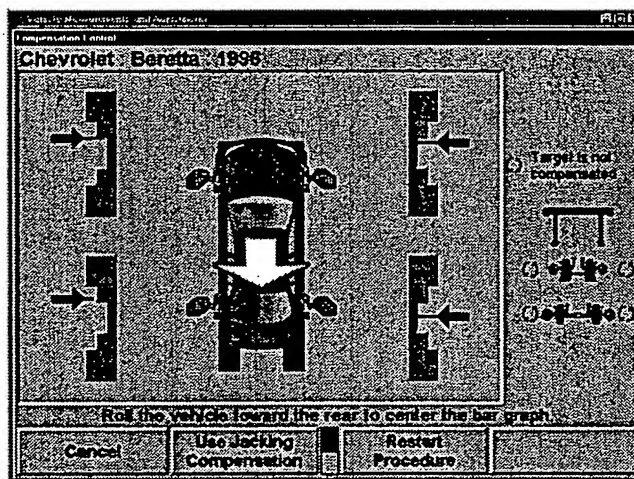
NOTE: It is recommended to roll the vehicle by rotating the left rear tire. Do not push or pull the vehicle by the front (steering axle) tires or wheels during rolling compensation. Do not push or pull on spoilers, fascia moldings, or other "trim" accessories.

The screen instructs you to roll the vehicle rearward. Release parking brake and put transmission in neutral. Roll the vehicle rearward until the bar graph turns green.



NOTE:

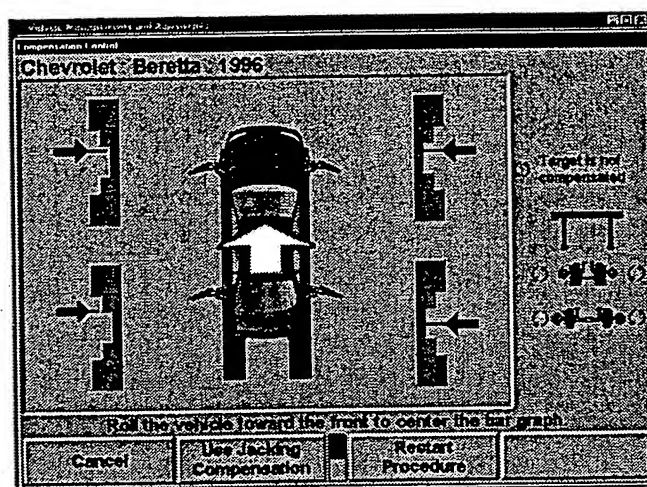
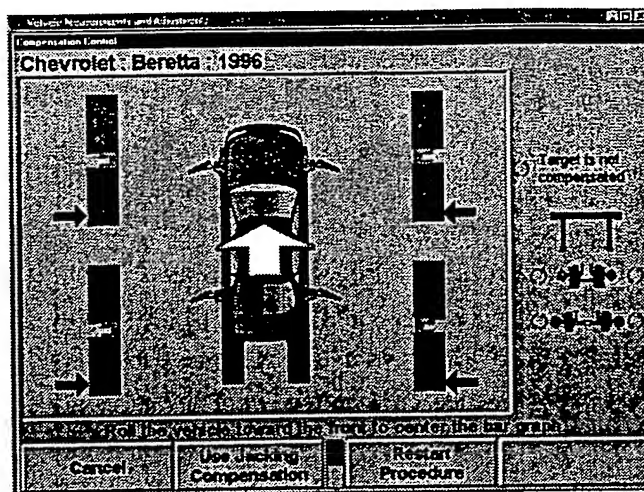
A vehicle with 28 inch diameter tires will require approximately 12 – 14 inches of movement. Smaller diameter tires will require less movement, while larger diameter tires will require more.



Stop rearward movement of the vehicle. The bar graph will disappear for a moment.

If a remote indicator is used, indicators for all four wheels will be flashing, indicating to roll forward.

When the compensation bar graph reappears, roll the vehicle forward to the original position.



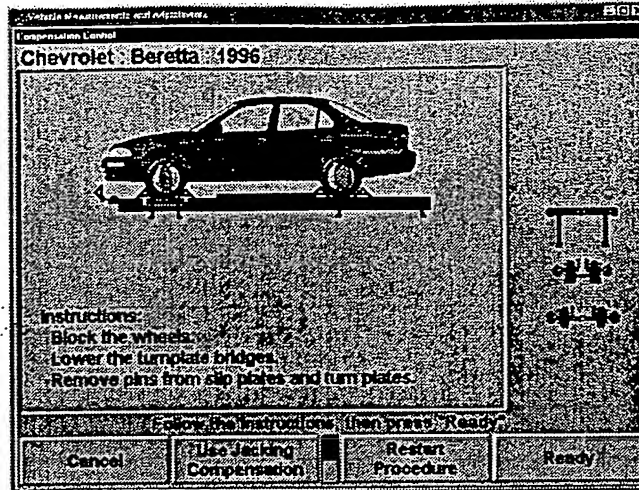
When all four targets have been compensated, apply the vehicle parking brake and place the transmission in park, if applicable. On standard transmission vehicles, the transmission should be placed in neutral.

Block the wheels.

NOTE:

The rolling compensation procedure **MUST** end with the vehicle in the proper position to check and adjust the alignment. The wheels are **NOT** allowed to rotate after the procedure is performed.

After the targets have been compensated, the "Compensation Control" popup screen will appear.



If not already done, block the wheels, then remove the pins from the turnplates, and slip plates.

Lower the turnplate bridges.

Rolling Compensation is complete.

Procedure Limitations of Rolling Compensation

When doing rolling compensation, certain requirements are necessary for the compensation to be correct.

With the wheels pointed ahead, a steering wheel lock should be installed.

NOTE: A change in the "pointing" direction of an axle during the procedure will be interpreted by the system as runout.

Do not allow the front wheels to change their "steering" direction as the vehicle is rolled.

Do not perform the procedure on a bumpy or uneven surface.

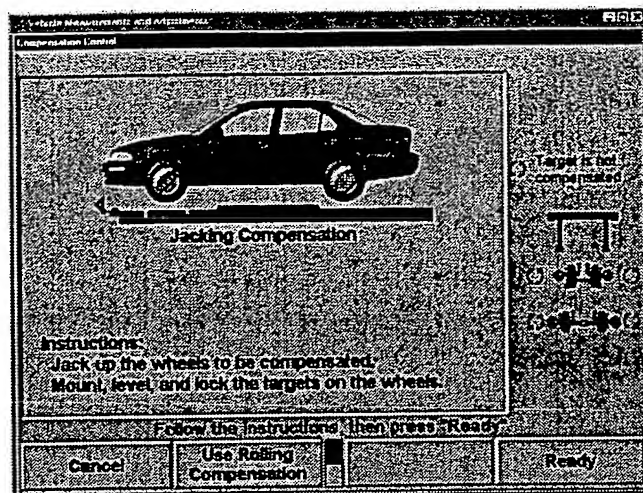
Do not perform the procedure on a vehicle that has uneven or out-of-round tires.

Do not push or pull the vehicle by the front tires or wheels during the procedure.

NOTE: It is recommended to roll the vehicle by rotating the left rear tire. Do not push or pull the vehicle by the front (steering axle) tires or wheels during rolling compensation. Do not push or pull on spoilers, fascia moldings, or other "trim" accessories.

3.3 Jacking Compensation

It is not necessary for all targets to be mounted before starting compensation. The targets may be mounted and compensated individually, or compensation may be performed on 1, 2, 3, or all 4 targets at once.



Raise both axles, while remembering to use the safety on all jacks.

The starting position of the wheel adaptor does not matter.

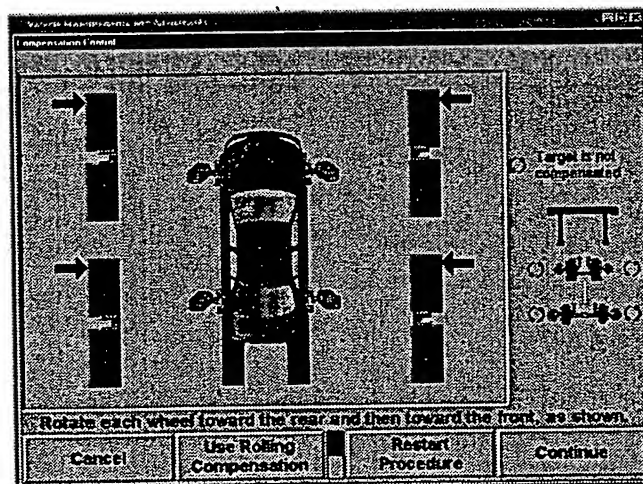
Insert the target into the wheel adaptor to the fully seated position.

Rotate the wheel until the target is level (as indicated by the spirit level on top of the target).

Hand tighten the target lock knob.

Press the "Ready" softkey.

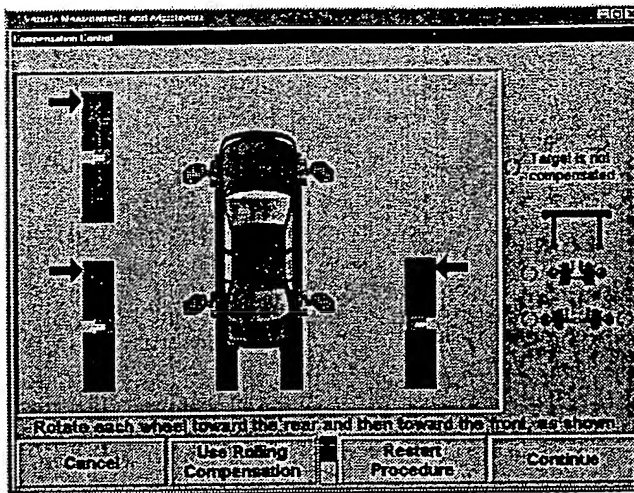
The "Compensation Control" screen will appear.



Rotate the wheel being compensated towards the rear of the vehicle (as if the vehicle were moving rearward).

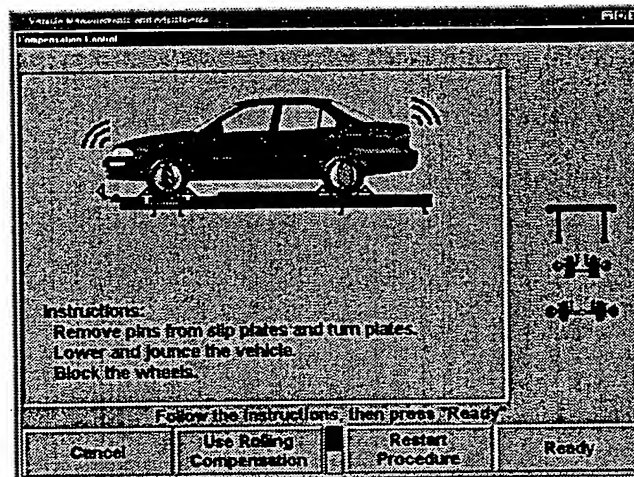
When the bar graph that corresponds to the wheel being compensated turns green, stop rotating the wheel. The bar graph will disappear for a moment.

When the bar graph reappears, rotate the wheel towards the front of the vehicle (as if the vehicle were moving forward) until the bar graph turns green again. If compensation was completed properly, the bar graph will disappear. If not, the compensation procedure will need to be redone.



The target is now compensated. Repeat this procedure for the remaining target(s).

After the targets have been compensated, the "Compensation Control" popup screen will appear.



Remove the lock pins from the turnplates and slip plates.

Apply the parking brake and place the transmission in park, if applicable.

Lower the vehicle onto the turnplates and rear slip plates.

Jounce the vehicle.

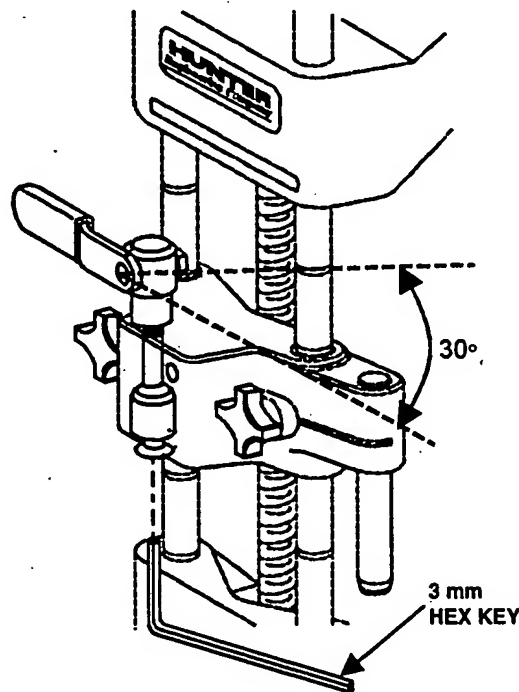
Jacking compensation is complete.

4. Operation Information

4.1 Adjusting Wheel Adaptor Lock Lever

The wheel adaptor lock lever should not contact the wheel adaptor center casting before the target shaft is tightly secured. An adjustment can be made to the lock lever assembly to restore its full tightening capability.

Turn the adjusting thumbscrew (on units without adjustment thumbscrews, use a 3 mm hex key) to adjust the lock lever adjustment screw as illustrated below (do not remove the assembly). The lock lever screw must be adjusted with the target fully seated in the adaptor and firm hand force applied to the lock lever. Adjust the lock lever screw from the bottom side of the center casting so the lever will stop approximately 30° short of contacting the center casting.



NOTE:

Normal manufacturing variations will allow the clearance between the lever and casting to change if different targets are mounted to a given adaptor. This variation is acceptable if the lever has enough travel to fully tighten the lock onto the shaft.

The Hunter Service Representative can be called to make the balance adjustments if necessary.

5. Maintenance

5.1 Target Maintenance

Keeping the DSP400 targets clean is the only required maintenance. Certain precautions should be followed.

Technicians should clean their hands thoroughly before handling the targets.

Keep hands and tools away from the target surface.

Keep the center casting of the wheel clamp tight, to prevent the target from falling off the vehicle.

Targets should not have any oil or grease on them. To remove oil or grease, the targets should be cleaned with mild window cleaning solution and a clean, soft cloth. Do **NOT** use shop towels.

NOTE: It is imperative that no metal particles are embedded in the cleaning cloth used on the target area.

DSP400 targets should be cleaned only when necessary. When the system has difficulties identifying a target or if there is a noticeable dirt build up, clean the targets.

When targets are not in use, store them in the sensor support to avoid scratches to the reflective surface. The target(s) should never be placed face down.

Targets that are broken or chipped must be replaced.

5.2 Camera Maintenance


Keep hands and tools away from the camera lens area.

Camera lenses should not have any oil or grease on them. To remove oil or grease, the lenses should be cleaned with mild window cleaning solution sprayed onto a soft cloth. Do **NOT** spray anything directly onto the camera.

Other than cleaning, all maintenance of the camera should be referred to an authorized Hunter Service Representative.

5.3 Care and Cleaning of the Targets

When cleaning, use a mild window cleaning solution to wipe off the targets and wheel adaptors.

 **CAUTION:** Do not hose down or submerge the targets in water. Do **NOT** spray cleaner directly on the target. This could damage the optical components.

Keep wheel adaptor rods cleaned and lubricated. Lubricate as needed with a coating of light lubricant such as WD-40.

 **CAUTION:** Do not lubricate the center screw shaft of the wheel adaptor.